

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (currently amended) An oxide dispersion strengthened nickel-chromium-iron alloy comprised, by weight:

Carbon 0.01 – 0.7%

Silicon 0.1 – 3.0%

Manganese 0 – 2.5%

Nickel 15 – 90%

Chromium 5 – 40%

Molybdenum 0 – 3.0%

Niobium 0 – 2.0%

Tantalum 0 – 2.0%

Titanium 1 – 2.0%

Zirconium 0 – 2.0%

Cobalt 0 – ~~2.0~~2.05%

Tungsten 0 – 4.0%

Hafnium 0.01 – 4.5%

Aluminum 0 – 15%

Nitrogen 0.001 – 0.5%

Oxygen 0.001 – 0.7%

balance iron and incidental impurities

with the proviso, that at least one carbide forming element whose carbide is more stable than chromium carbide selected from niobium, titanium, tungsten, tantalum and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

2. (currently amended) An oxide dispersion strengthened nickel-chromium-iron alloy comprising, by weight:

Carbon	0.01 to 0.5%
Silicon	0.01 to 2.5%
Manganese	0 to 2.5%
Nickel	15 to 50%
Chromium	20 to 40%
Molybdenum	0 to 1.0%
Niobium	0 to 1.7%
Titanium	0 to 0.5%
Zirconium	0 to 0.5%
Cobalt	0 to 2.0 <u>2.05</u> %
Tungsten	0 to 1.0%
Hafnium	0.01 to 4.5%

balance iron and incidental impurities

with the proviso that at least one of niobium, titanium and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

3. (currently amended) An alloy according to claim 1 having the following composition, by weight:

Carbon	0.3 to 0.7%
Silicon	0.4 <u>0.01</u> to 2.5%
Manganese	2.5% max.
Nickel	30 to 40%
Chromium	20 to 30%
Molybdenum	3.0% max.
Niobium	2.0% max.
Hafnium	0.01 to 4.5%
Titanium	0.5% max.
Zirconium	0.5% max.
Cobalt	2.0% max.
Tungsten	1.0% max.
Nitrogen	0.001 – 0.5%
Oxygen	0.001 – 0.7%

Balance iron and incidental impurities,

with the proviso that at least one of niobium, titanium and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

4. (currently amended) An alloy according to claim 1 having the following composition, by weight:

Carbon	0.03 to 0.2%
Silicon	0.1 to 0.25%
Manganese	2.5% max.
Nickel	30 to 40%
Chromium	20 to 30%
Molybdenum	3.0% max.
Niobium	1.7% max.
Hafnium	0.01 to 4.5%
Titanium	0.5% max.
Zirconium	0.5% max.
Cobalt	2.05 <u>2.0</u> % max.
Tungsten	1.0% max.
Nitrogen	0.001 – 0.5%
Oxygen	0.001 – 0.7%

balance iron and incidental impurities,

with the proviso that at least one of niobium, titanium and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

5. (original) An alloy according to claim 1 having the following composition, by weight:

Carbon	0.3 to 0.7%
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Silicon	0.01 to 2.5%
Manganese	2.5% max.
Nickel	40 to 60%
Chromium	30 to 40%
Molybdenum	3.0% max.
Niobium	2.0% max.
Hafnium	0.01 to 4.5%
Titanium	1.0% max.
Zirconium	1.0% max.
Cobalt	2.0% max.
Tungsten	1.0% max.,
Aluminum	0 – 15.0% max.
Nitrogen	0.001 – 0.5%
Oxygen	0.001 – 0.7%

balance iron and incidental impurities,

with the proviso that at least one of niobium, titanium and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

6. (original) An alloy according to claim 1 having the following composition, by weight:

Carbon	0.03 to 0.2%
Silicon	0.1 to 2.5%

Manganese	2.5% max.
Nickel	40 to 50%
Chromium	30 to 40%
Molybdenum	3.0% max.
Niobium	2.0% max.
Hafnium	0.01 to 4.5%
Titanium	0.5% max.
Zirconium	0.5% max.
Cobalt	2.0% max.
Tungsten	1.0% max.,
Aluminum	0 – 15.0% max.
Nitrogen	0.001 – 0.5%
Oxygen	0.001 – 0.7%

balance iron and incidental impurities,

with the proviso that at least one of niobium, titanium and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

7. (original) An alloy according to claim 1 having the following composition, by weight:

Carbon	0.3 to 0.7%
Silicon	0.01 to 2.5%
Manganese	2.5% max.

Nickel	19 to 22%
Chromium	24 to 27%
Molybdenum	3.0% max.
Niobium	2.0% max.
Hafnium	0.01 to 4.5%
Cobalt	2.0% max.
Tungsten	1.0% max.,
Aluminum	0 – 15.0%
Nitrogen	0.001 – 0.5%
Oxygen	0.001 – 0.7%

balance iron and incidental impurities,

with the proviso that at least one of niobium, titanium and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

8. (original) Any alloy according to claim 1 having the following composition, by weight:

Carbon	0.03 to 0.2%
Silicon	0.1 to 2.5%
Manganese	2.5% max.
Nickel	30 to 45%
Chromium	19 to 22%
Molybdenum	3.0% max.

Niobium	2.0% max.
Hafnium	0.01 to 4.5%
Titanium	0.5% max.
Zirconium	0.5% max.
Cobalt	2.0% max.
Tungsten	1.0% max.
Aluminum	0 – 15.0%
Nitrogen	0.001 – 0.5%
Oxygen	0.001 – 0.7%

balance iron and incidental impurities

with the proviso that at least one of niobium, titanium and zirconium is present and that at least part of the hafnium is present as finely divided oxide particles.

9. (original) An alloy according to any one of claims 1, 2, 3, 5, or 7, having a carbon content of from 0.3 to 0.5% by weight.

10. (original) An alloy according to claim 1 or 2, having a carbon content of from 0.03 to 0.2% by weight.

11. (original) An alloy according to claim 1, in which the amount of carbon in the alloy, by weight, is from 0.3 to 0.6% and the amount of hafnium in the alloy, by weight, is from 0.01 to 3.0%

12. (original) An alloy according to claim 11, in which the amount of carbon in the alloy, by weight, is from 0.3 to 0.6% and the amount of hafnium in the alloy, by weight, is from 0.1% to 1.0%.

13. (original) An alloy according to claim 11 or 12, in which the amount of carbon in the alloy, by weight, is from 0.3 to 0.6% and the amount of hafnium in the alloy, by weight, is from 0.2 to 0.5%.

14. (currently amended) An alloy according to any one of ~~the preceding~~ claims 1-8 and 11-12, in which the amount of carbon in the alloy, by weight, is from 0.03 to 0.2% and the amount of hafnium in the alloy, by weight, is from 1 to 4.5%.

15 – 17. (cancelled)

18. (currently amended) An alloy according to any one of ~~the preceding~~ claims 1-8 and 11-12, in which the hafnium is present in the alloy in the form of finely divided oxidised particles having an average particle size of from 50 microns to 0.25 microns, or less.

19. (currently amended) An alloy according to any one of ~~the preceding~~ claims 1-8 and 11-12, in which the hafnium is present in the alloy in the form of

finely divided oxidised particles having an average particle size of from 5 microns to 0.25 microns, or less.

20. (currently amended) An alloy having any one of the following compositions, by weight:

Carbon	0.45%
Silicon	1.3%
Manganese	0.9%
Nickel	33.8%
Chromium	25.7%
Molybdenum	0.03%
Niobium	0.85%
Hafnium	0.25%
Titanium	0.1%
Zirconium	0.01%
Cobalt	0.04%
Tungsten	0.01%
Nitrogen	0.1%
Iron	balance,

with the proviso that at least one of niobium at 0.85%, titanium at 0.10% and zirconium at 0.01% is present and that at least part of the hafnium is present as finely divided oxide particles.

Carbon	0.07%
Silicon	1.0%
Manganese	0.98%
Nickel	32.5%
Chromium	25.8%
Molybdenum	0.20%
Niobium	0.04%
Hafnium	1.1%
Titanium	0.12%
Zirconium	0.01%
Cobalt	0.04%
Tungsten	0.08%
Nitrogen	0.1%
Iron	balance,

with the proviso that at least one of niobium at 0.04%, titanium at 0.12% and zirconium at 0.01% is present and that at least part of the hafnium is present as finely divided oxide particles.

Carbon	0.34%
Silicon	1.68%
Manganese	1.10%
Nickel	32.0%
Chromium	21.3%

Molybdenum 0.01%

~~Niobium~~ 0.80%

Hafnium 0.25%

~~Titanium~~ 0.12%

~~Zirconium~~ 0.01%

Aluminum 3.28%

Cobalt 0.04%

Tungsten 0.01%

Iron balance,

with the proviso that at least one of niobium at 0.80%, titanium at 0.12% and zirconium at 0.01% is present and that at least part of the hafnium is present as finely divided oxide particles.

Carbon 0.42%

Silicon 1.79%

Manganese 1.17%

Nickel 33.2

Chromium 23.3%

Molybdenum 0.02%

~~Niobium~~ 0.77%

Hafnium 0.24%

~~Titanium~~ 0.10%

~~Zirconium~~ 0.01%

Aluminum 1.64%

Cobalt 0.04%

Tungsten 0.08%

Iron balance,

with the proviso that at least one of niobium at 0.77%, titanium at 0.10% and zirconium at 0.01% is present and that at least part of the hafnium is present as finely divided oxide particles.

21. (currently amended) An alloy according to any one of ~~the preceding~~ claims 1-8, 11-12 and 20 substantially as described in Examples 1 to 4.

22. (cancelled)

23. (withdrawn) A nickel-chromium-iron alloy comprising up to about 5% of hafnium-containing particles.

24. (withdrawn) An oxide dispersion strengthened nickel-chromium-iron alloy which comprises up to about 5% by weight of hafnium, with at least part of the hafnium being present as finely divided oxidised particles.

25. (cancelled)

26. (withdrawn) A method of manufacturing an oxide dispersion strengthened nickel-chromium-iron alloy which comprises adding finely divided hafnium particles to a melt of the alloy before pouring, under conditions such that at least part of the hafnium is converted to oxide in the melt.

27. (withdrawn) A method according to claim 26, in which the alloy is an alloy as claimed in any of claims 1 to 25.

28. (withdrawn) A method according to claim 26 or 27, wherein the hafnium particles have a particle size of less than 50 microns.

29. (withdrawn) A method according to any one of claims 26 to 28, in which the amount of hafnium added to the melt is from 0.01 to 3.0% by weight.

30. (withdrawn) A method according to any one of claims 26 to 29, wherein the hafnium particles are added to the melt shortly before pouring the molten alloy into a mould.

31. (withdrawn) A method according to claim 30, in which the hafnium particles are added to the molten alloy in a ladle.

32. (withdrawn) A method according to claim 30, in which the hafnium particles are added to the molten alloy in the furnace.

33. (withdrawn) A method according to anyone of claims 26 to 32, in which the hafnium is electrolytic hafnium.

34. (withdrawn) A method according to any one of claims 26 to 33, wherein the level of oxygen in the melt is varied by the addition of one or more substance selected from the group:

- silicon,
- chromium,
- manganese,
- calcium,
- CaSi,
- CaSiMn,
- niobium,
- titanium,
- zirconium.

35. (withdrawn) A method of manufacturing an oxide dispersion strengthened nickel-chromium-iron alloy which comprises adding finely divided hafnium particles to a melt of the alloy and varying the level of oxygen in the melt by, the addition of at least one substance chosen from the group:

- silicon,
- chromium,
- manganese,

calcium,
CaSi,
CaSiMn,
niobium,
titanium,
zirconium.

36. (withdrawn) A method of manufacturing an oxide dispersion strengthened nickel-chromium-iron alloy which comprises adding finely divided hafnium particles to a melt of the alloy before pouring, under conditions such that the formation of detrimental oxide from the reactive elements titanium, zirconium, aluminum is reduced.

37. (withdrawn) A method according to any one of claims 26 to 36 wherein any one of the elements titanium or zirconium are added after hafnium into the melt.

38. (withdrawn) A method as claimed in claim 37 wherein any one of the elements titanium or zirconium are added after the hafnium in the melt, and just before pouring into the mould.

39. (withdrawn) A method of manufacturing an oxide dispersion strengthened nickel-chromium-iron alloy which comprises adding finely divided

hafnium particles to a melt of the alloy and which controls the partial pressure of oxygen to permit the oxidation of the hafnium in situ.

40. (withdrawn) A method of manufacturing an oxide dispersion strengthened nickel-chromium-iron alloy which comprises adding finely divided hafnium particles to a melt of the alloy and which controls the free oxygen content to permit the oxidation of the hafnium in situ.

41. (withdrawn) A method of manufacturing an oxide dispersion strengthened nickel-chromium-iron alloy which comprises adding finely divided hafnium particles to a melt of the alloy and which controls the partial pressure of at least one element selected from the following group:

oxygen,

carbon,

nitrogen,

hydrogen;

to permit the oxidation of the hafnium in situ.

42. (withdrawn) A method of manufacturing an oxide dispersion strengthened nickel-chromium-iron alloy which comprises adding finely divided hafnium particles to a melt of the alloy and which permits the oxidation in situ of beneficial oxide dispersion as hafnium oxide, avoiding the formation of detrimental precipitates.

43. (withdrawn) A method as claimed in claim 42 which limits in situ oxidation to beneficial oxide dispersion of hafnium oxides and avoid its reaction with slag.

44. (cancelled)

45. (withdrawn) A method according to any of claims 26 to 44, in which the melt temperature is in the range of from 1350°C to 1700°C.

46 – 47. (cancelled)

48. (withdrawn) A method according to any one of claims 26 to 47, in which the alloy is formed into a tube by rotational moulding.

49. (withdrawn) A method according to any one of claims 26 to 48 substantially as described in Examples 1 to 4.

50. (cancelled)

51. (withdrawn) A method of manufacturing a nickel-chromium-iron alloy, which comprises adding finely divided hafnium particles to the melt before pouring.

52. (withdrawn) A creep resistant alloy tube formed from a nickel-chromium-iron alloy comprising up to about 5% of hafnium-containing particles.

53. (withdrawn) A tube according to claim 52, which comprises an oxide dispersion strengthened nickel-chromium-iron alloy comprising up to about 5% of hafnium.

54. (withdrawn) A nickel-chromium-iron alloy tube comprising up to about 5% of hafnium-containing particles substantially as herein before described.

55. (currently amended) A tube formed from an alloy according to any one of claims 1-8, 11-12, 20, and 23-24 ~~1 to 25~~ by rotational moulding.

56. (withdrawn) A nickel-chromium-iron alloy having a structure and composition substantially as described and illustrated in any one of Figures 1 to 4 of the accompanying Drawings, wherein the tables represent percentages by weight of the alloy constituents.

57. (withdrawn) A nickel-chromium-iron alloy having a structure substantially as described and illustrated in Figures 5 or 6 of the accompanying Drawings.

58 – 59. (cancelled)

60. (currently amended) A tube formed from an alloy according to any of claims 1-8, 11-12, 20 and 23-24 ~~1 to 25~~ by rotational moulding.

61. (currently amended) An alloy according to any one of claims 1-8, 11-12, 20, 23-24 ~~1 to 25~~, 56 and 57 produced by a method according to any one of claims 26 to 51.